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ABSTRACT

Reducing math anxiety and building basic mathematical skills should not be treated as separate processes, but can and should be undertaken simultaneously. To do so requires a positive attitude on the part of the instructor; the establishment of an atmosphere in the classroom that encourages learning; and the instructor's awareness of different student learning styles (i.e., the differences between tactile, visual, and auditory learners). Dealing with math anxiety in traditional classes involves three stages. The first stage is to recognize the problem of math anxiety and bring it out into the open. Students can be encouraged to explore their attitudes about mathematics through math autobiographies and discussions centered on positive and negative statements about math. The second stage involves looking at mathematics in disguise, by, for example, considering math problems found in newspapers or encountered in everyday life. During classroom discussions, specific computational skills, laws, and algorithms can be reviewed, and analytical elements can be addressed. Once students have actually done some computations, instructors can begin building math strategies, the third stage. Tips for working with mathematics can be distributed, discussed, and applied in group work situations. By applying these approaches, teachers can overcome patterns of math avoidance and anxiety in the basic skills classroom. (HB)

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COMBATting MATH ANXIETY WHILE BUILDING BASIC SKILLS:
THERE IS TIME FOR BOTH

By Ann M. Lasher

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Combatting Math Anxiety While Building Basic Skills -
There is Time for Both

Reducing math anxiety and building basic skills have traditionally been treated as two separate processes. Not only do I believe that they can be done simultaneously, but also I believe they must be. A math-anxious person cannot overcome the fear of mathematics until he or she has had a successful experience doing mathematics. And a person deficient in basic skills will not overcome these deficiencies until he or she has a familiarity with and a control over the math environment that any presence of anxiety will foil. Thus one problem cannot be isolated from the other. Recognition of the presence of math anxiety in developmental students and knowledge of traditional math anxiety reduction techniques have led me to reassess methods, to analyze the role of the developmental instructor, and to develop classroom techniques that aid students in overcoming their anxiety while they are mastering skills.

Anxiety, as distinguished from fear, is tension that has no apparent cause. Math anxiety, then, can be viewed as a tension that interferes with mathematical performance and is not ability related or related to any apparent cause. The tension present in a math-anxious person is a debilitating type of tension, one which blocks the learning process when the student is confronted by a mathematical situation. The symptoms of math anxiety have always been observable in the classroom, but the causes and ways to overcome the problem began to be seriously studied only in the mid-1970's. Two of the most famous and successful programs for dealing with math anxiety were the Wesleyan Math Clinic, founded by Sheila Tobias in 1975, and the Mind Over Math Clinic, co-founded by Stanley Kogelman and Joseph Warren in New York City shortly after the Wesleyan Clinic. The

main objectives in both pioneer clinics were for participants to overcome their anxiety and to increase their confidence in doing mathematics. Although mathematics was presented, any work in it was done primarily to elicit the psychological response of the participants, not to build their basic skills. Presently math anxiety reduction programs are being established at many institutions, and private consulting firms are dealing with clients' apparent math anxiety outside of the classroom setting. It is the intent of most models to spend seven to ten hours doing anxiety alleviation before any math skill building is done, if at all. Anxiety alleviation attempted outside the classroom can and should be structured in this way to meet the needs of the person with marked anxiety. Unfortunately, the time constraints of a ten-week quarter or a fifteen-week semester make this structure impractical for a standard developmental mathematics course.

The emphasis in developmental classes has traditionally been on building skills, not on alleviating anxiety. New innovative approaches, programmed texts, computer assisted instruction, audio-visual aids, tapes, film strips, one-to-one tutoring, and learning labs have all been employed to try to make developmental courses more palatable to students. But still some students do not respond. Most new teaching methods assume that the student is self-motivated and willing to take control of his or her learning. However, most developmental students do not feel in control of or involved in their learning. Many of them leave college because they are failure identifiers: they have failed before, they expect to fail, and so they do. Trying to make courses "relevant" will not solve these kinds of problems; rather, clues as to why failure occurred in the past must be sought, and opportunities for success must be provided to the students. Here lies the important connection between math anxiety reduction and basic skills courses.

Math anxiety, the block to skills acquisition, must be at least suspected in developmental students. Most developmental students have serious doubts about their ability to learn and retain math skills and begin their course work with a certain degree of anxiety.

There are ways to deal with student anxiety in basic as well as regular courses. They relate primarily to a positive attitude on the part of the instructor and result in the establishment of an atmosphere in the classroom that encourages learning. Crucial to instructor attitude in the developmental classroom is whether the instructor wants to be there. Care should be taken that developmental classes are taught by persons interested in or familiar with the special characteristics of developmental students, rather than assigned to part-time or new faculty members.

Once in the classroom, the instructor must develop a sense of openness and trust. Students very often view math instructors as dry, cold and errorless. By displaying a sense of humor, by making errors in computations gracefully, and by using this as an opportunity for learning, instructors can help to correct this view. The developmental mathematics instructor who fosters class discussions and group work can make the students feel secure enough to question and volunteer information without fearing humiliation.

In addition to creating a relaxed atmosphere in the classroom, the instructor must be aware of the different learning styles of the students. Much research is now being done into the various cognitive styles that people use to process information. Though a very complex subject, instructors can be aware of some of the obvious variations in learning styles. For example, some persons respond best to visual stimuli, preferring to use reading materials as a primary source of learning and preferring to communicate what is learned by writing it. Others may be auditory learners, preferring to hear directions and to rephrase what was heard. Yet others may be kinesthetic

or tactile learners who learn best by seeing something done and by actually doing it themselves. They would like to manipulate mathematical models, for example. Instructors need to be flexible enough to present courses in such a way that students with learning styles different from the instructor's own can be successful.

Instructors can also adapt many of the math anxiety reduction techniques used in workshop models for use in the classroom. Addressing the problem of math anxiety in traditional classes involves three stages.

The first stage is to recognize the problem and bring it out into the open. Basic skills students come from varied backgrounds and age groups, but they have one common characteristic. They perceive a real need to learn basic skills, but are anxious about their ability because many have failed in the past and have developed patterns of math avoidance. The instructor's first responsibility involves helping the students discover why they did not master the skills in the past. One technique that elicits discovery involves letting students explore their attitudes toward mathematics. A discussion of these attitudes, coupled with an exchange of both positive and negative personal experiences in mathematics, helps them understand their failures and helps to set the pattern of student participation in the course from the beginning.

Two methods which foster discussion suggested by math anxiety reduction models are the math autobiography and math self-talk. Students are asked to write a math autobiography in which they catalog their personal math background beginning with their family and early school experiences. Math self-talk contains a series of positive and negative statements describing reactions to situations involving mathematics. An example of a negative statement would be, "I can't get it; I never was good at math." A parallel

positive statement would be, "I don't know how to do this right now, but I will find out how to do it." Students are led to recognize the negative thinking and statements which hinder a growth in mathematical confidence and are encouraged to replace negative comments with positive ones.

Another method I have used to stimulate class discussion requires students to complete a math attitude survey which lists some common math myths and asks students to rate them in terms of agreement or disagreement with them on a five point scale. I have adapted many of these statements from Mind Over Math by Stanley Kogelman and Joseph Warren, and Overcoming Math Anxiety by Sheila Tobias. I used the following statements to generate comments and group discussion:

1. I enjoy doing math.
2. Only students who want to take a math course in college should take one.
3. Math is a cut and dry subject. You are either right or wrong.
4. Some people have a math mind.
5. Math is relevant to everyday life.
6. There is usually just one way to do a math problem.
7. If you can't learn math before coming to college, you'll never learn it.
8. Math is an abstract subject.
9. Mathematicians keep working on a problem until it is done.
10. Mathematicians do problems quickly, usually in their heads.
11. I am afraid of math.
12. Math is creative.
13. People no longer need to do math since calculators can be used.
14. Mathematicians are dull and a little odd.

Once the instructor and students have explored these attitudes, it is time to proceed with the second stage: looking at mathematics in disguise. Since most developmental students feel they are not capable of performing any operations of math successfully, the introduction to mathematics must be non-threatening and something the students can do. For example, students can share problems found in newspapers or problems that they encounter in everyday life during class discussions. Giving students a hidden math story problem can also be effective. In one story situation, for instance, a student must go to visit his aunt to pick up some books he had stored with her during college. Information about temperature, time, mileage, and costs are interspersed throughout the story. Students make up problems about gas mileage, money spent, temperature change, and averaging. They also record the feelings they had while working on the problems. Subsequent class discussion of these problems is lively; the interest in them is high since students have created them. This exercise, which can be used for virtually any mathematics level, encourages students to use written, verbal, and logic skills. During discussion of the problems specific computational skills, laws, and algorithms can be reviewed, while at the same time analytical elements, such as the importance of making assumptions and knowing when sufficient data are present to solve the problems, can be addressed. For example, the student in the story situation packed sixty books in five boxes. When asked how many books were packed in each box, students generally answer twelve. However soon someone questions whether all of the boxes and all of the books were the same size. From this easily understood example, the students can begin a preliminary discussion about statistics, including the implications and shortcomings of their use.

Once students have actually looked at math and done some computations, instructors can begin to build math strategies, the third stage. Students appreciate written tips on reading math books, on taking math tests, and on relaxation techniques. Tips for working with mathematics can be found at the beginning of many developmental mathematics books and books on math anxiety. The following are the tips I present to my developmental classes:

1. Start with what you can do.
2. Always keep a pencil or pen and paper handy. Write down everything that may be important. You can always discard irrelevant information later.
3. Slow down. Read slowly and analyze. You cannot read a math book like you would a novel.
4. Communicate with the problem.
5. Take breaks from your work. Your unconscious will work while you are resting. When you come back to the work, you will have new insights.
6. Practice mathematics every day.
7. Trust your intuition. There is not always one right way to look at a problem.
8. If a problem is too difficult because of the numbers involved, try it with simple numbers. Try to see what method you need, then deal with the more difficult calculations.

The tips are purposely short and are presented to students on a single sheet of paper with ample space between statements for students to add their own comments or elaborate on the ones presented. After distributing this list to the class, discussing, adding to, and accepting them, the class has the opportunity to immediately apply some of the tips to problems in group work situations. For many developmental students, working with mathematics involves only doing computations in order to achieve the "correct" answer. I stress the importance of analyzing, of deciding what to do and what is a reasonable expectation of outcome, rather than stressing

the actual computational work. Through the technique of presenting, discussing, and applying math tips, students try their hand at the preliminary analysis of a problem perhaps for the first time.

Instructors applying the techniques suggested in this paper will begin to overcome patterns of math avoidance and anxiety in the basic skills classroom. Problem analysis is certainly more interesting than a dry drill on basics, and it encourages the student to take control of mathematical situations. In this way math confidence is increased while anxiety and avoidance are lessened. Through open discussion students find that they are not alone and that others experience the same problems with mathematics. Through group work students find that they can learn from their peers. This discovery helps mold the class into a cohesive group, with participation and responsibility for learning shared by the students and instructor. Rather than taking time away from skill building, these techniques can encourage it.

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